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Maritimes Region

**Proceedings of the Maritimes Region
Science Advisory Process to Review
Assessment of Lobster Stock Status
in LFAs 27-33**

**July 21-22, 2011
Dartmouth, Nova Scotia**

**Ross Claytor
Meeting Chair**

**Tana Worcester
Editor**

S C C S

Secrétariat canadien de consultation scientifique

Compte rendu 2012/019

Région des Maritimes

**Compte rendu du processus consultatif
scientifique de la Région des Maritimes
visant l'examen de l'évaluation de l'état
du stock de homard dans les zones de
pêche du homard (ZPH) 27 à 33**

**21-22 juillet 2011
Dartmouth (Nouvelle-Écosse)**

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Président de réunion**

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Bedford Institute of Oceanography
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June 2012

Juin 2012

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. Le compte rendu peut aussi faire l'état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

A Maritimes Region Science Regional Advisory Process (RAP) was conducted on July 21-22, 2011 at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia to conduct an assessment for Lobster Fishing Areas (LFA) 27-33. Participation in this meeting included Fisheries and Oceans Canada (DFO), Province of Nova Scotia, the fishing industry, and aboriginal communities. The results of this meeting formed the basis for science advice to fishery managers on LFA 27-33 lobster. Three DFO Science Research Documents and a Science Advisory Report are to be produced as a result of this meeting.

SOMMAIRE

Un processus consultatif scientifique de la Région des Maritimes a été mené les 21 et 22 juillet 2011 à l'Institut océanographique de Bedford à Dartmouth (Nouvelle-Écosse) pour évaluer l'état du stock dans les zones de pêche du homard (ZPH) 27 à 33. Les participants à cette réunion comprenaient des représentants de Pêches et Océans Canada (MPO), du gouvernement de la Nouvelle-Écosse, de l'industrie de la pêche et de collectivités autochtones. Les résultats de cette réunion ont servi de base pour l'avis scientifique donné aux gestionnaires des pêches à propos du stock de homard des ZPH 27 à 33. Trois documents de recherche du Secteur des sciences du MPO et un avis scientifique doivent être produits à la suite de cette réunion.

INTRODUCTION

The status of the lobster resources in Lobster Fishing Areas (LFAs) 27-33 was last assessed in 2004. Fisheries and Aquaculture management requested updated information on the status of the LFA 27-33 lobster stocks. To provide this advice on the status of these LFAs a framework meeting was held from February 1-3, 2011. That meeting established the scientific basis for the provision of management advice for LFAs 27-33 (DFO 2011). The current assessment meeting was conducted on July 21-22, 2011, to provide an update of the status of the LFA 27-33 lobster stocks following the new assessment framework.

The objectives of the meeting were to:

1. Assess the stock status of the LFA 27-33 lobster stocks as of the end of the 2010 seasons.
2. Estimate the relative exploitation rates over the last 10 years and evaluate the consequences of maintaining the current harvest levels.
3. Estimate the level of discards (including lobster) and retention of non-lobster species in the LFA 27-33 lobster fisheries and report on what information is available on the survival of discarded species.
4. Estimate the current values for female size at 50% maturity.

ASSESSMENT

FOLLOW-UP ON POINTS RAISED DURING FRAMEWORK

FSRS Recruitment Traps

The concern expressed at the framework was that there was a spatial and temporal difference between the Fishermen and Scientists Research Society (FSRS) recruitment traps and commercial fishery traps that would bias any conclusions on fishery effects on the population by using the FSRS data.

Material presented at the meeting concluded that the sizes in FSRS traps appear to be a good representation of what is captured in at-sea samples of the commercial catch. There was good agreement between the sizes sampled by FSRS traps and those sampled by at-sea samples in LFAs 27, LFA 31A and LFA 33 in the spring. In the fall period in LFA 33, the correspondence between the two data sets was not as good. During the fall, the fishery is in deeper water and thus represents a different portion of the population than the FSRS data for the same time period.

There is a separate program in LFA 33 to record similar data from commercial traps. It was suggested that analysis of these data would be an important consideration for the next assessment cycle. It was noted that fishermen are asked to record any changes in sites. It was recommended to report on depths of the recruitment traps versus commercial traps in future assessments.

LFA Grouping - Cluster Analysis

During the framework, three stock assessment units were defined based on cluster analysis of historical landings of Statistical Districts (smaller than LFAs): LFA 27, LFAs 28-32 and LFA 33. Size composition and other biological data supported the cluster analysis. No alternative methods for examining clusters were used. The results obtained using methods that other researcher have used are well understood and correspond with expectations. Where appropriate, analysis at subunit levels was provided in the assessment.

FISHERY PERFORMANCE INDICATORS

The performance indicators evaluated include landings, and effort from mandatory and voluntary logs, and median size in catch.

Landings

It was recognized that landings are not a very sensitive indicator of lobster abundance. Nevertheless, landings are the only available proxy for lobster abundance that has a time series greater than 20 years for LFAs in the Maritimes Region. Candidate reference points in the Integrated Fisheries Management Plan (IFMP) are based on landings. It is also important to note that landings vary similarly across LFAs and give indications of general trends and patterns in abundance.

Effort and Catch per unit Effort (CPUE)

CPUEs from voluntary logs come from fewer fishermen than the mandatory logs, but for some LFAs, the time series is 10-20 years longer than the mandatory logs. Unstandardized CPUE from mandatory logs corresponds well with unstandardized CPUE from voluntary logs where the two data types overlap. It was noted that raw effort statistics do not capture change in fishing location from inshore to offshore in these LFAs.

Median size

Changes in median size can be used to identify possible recruitment events. A decrease in the median size is consistent with increasing recruitment as larger numbers of lobsters are recruited to legal size. This interpretation is complicated in some LFAs by changing minimum size regulations. Methods such as the FSRS traps and sea samples that sample a broader size range would be more sensitive to these changes than commercial traps affected by regulation.

ABUNDANCE INDICATORS FROM FSRS TRAPS

Standardized CPUE for Sublegal and Legal

The main abundance trends for all assessment units in recent years come from CPUE expressed in numbers per trap haul (N/TH) or weight per trap haul (kg/TH).

A mixed effects model for LFA 27 was applied as described in 27 (Tremblay et al. 2011). This model has year and week as fixed effects, and the vessel (= fisherman) effect as a random factor. This model was developed to deal with geographic differences within LFA 27, and to overcome the challenge of changing vessels over time within LFA 27.

For LFAs 28, 29, 30, 31a, 31b and 32 the application of a single model was thought to be inappropriate because of the different start dates of the fishing season. LFA 31b and LFA 32 for example start on April 19th; LFA 30 does not start until May 20th. We explored a mixed effect model for LFA 33 and for LFA 29 and 31a combined (the latter two LFAs have similar seasons), but the diagnostic plots indicated a poor fit for the models selected.

As a result GLM models were applied to each individual LFA. CPUE was modeled as a function of week, year and vessel with the latter as a fixed effect.

The model description is important to include in the Research Document as the description in the working paper was incomplete. Including the model specification would make it clear which effects (week, season, and any interaction terms for example) are included in the model.

Estimates were done for subunits and then weighted by (i) landings and (ii) length of rocky shore to provide an index for the assessment unit as a whole. It was concluded that for this measure that is based on FSRs traps, weighting by length of rocky shore was appropriate.

Questions were raised about the definition of rocky shore, and it was asked that this definition be included in the Research Document. However, it was noted that the definition would not affect estimates of exploitation rate within a section of shore, but it would affect the weighting factor when sections of shore are combined.

For LFA 27, the conclusion was that overall abundance of sublegals increased, largely due to the increases in MLS; there was no trend in abundance in legal sizes in LFA 27 overall but because the median size increased, catch rates in weight increased. Differences exist among subunits. Overall median currently above median for 1999-2007 and that currently above median for 1999-2007.

For LFAs 28-32, it was concluded that overall abundance of sublegals increased over the decade and although abundance has recently declined, it is still high relative to 2000-2002. There are some differences among LFAs. For commercial sizes, it was concluded that current abundance is relatively high but may have peaked. There are some differences among LFAs.

For LFA 33, it was concluded that overall abundance of sublegals has trended upwards, while overall abundance of legal sizes has fluctuated without trend.

The potential influence of aquaculture sites on changes in lobster distribution and fishing patterns needs to be examined to determine the importance of these sites to any changes in CPUE. In general, any change in fishing activity for whatever reason should be assessed for impact on results and interpretation of trends.

TEMPERATURE CORRECTED ABUNDANCE FOR LFA 33

For LFA 33 only, it was possible to apply a mathematical model that simultaneously produces an estimate of the temperature-catchability relationship, a temperature-corrected catch-per-unit-effort based abundance index (TCAI), and a spatial abundance index for a non-exploited class of a population of lobsters was presented using the FSRs recruitment trap data. The TCAI is obtained from a probabilistic model of the catch from a single sampling event as a function of the number of crustaceans available at the sampling location, the current temperature, and the catchability-temperature relationship. The parameters of the model, including the TCAI, are estimated by maximum likelihood, and standard errors are obtained using Wald's method. Model diagnostic procedures are proposed. The model is applied to data from LFA 33. In

LFA 33, there is a strong linear association between catchability and water temperature, suggesting that the TCAI is an improved abundance indicator compared to uncorrected CPUE. An analysis of additional information from the dataset and the fitted model indicates that agonistic behaviour does not impact catchability. The TCAI indicates that the abundance of prerecruit lobsters in LFA 33 increased substantially (~ 1.7 fold) from 1999 to 2009. The authors were encouraged to publish this work as a Research Document.

SIZE AT MATURITY

Size at onset of maturity (SOM) for female lobsters was estimated for 3 locations in Cape Breton from 2006-2008 (Reeves et al. 2011). SOM estimates varied annually, spatially and seasonally. Best estimates for SOM50 (size at which 50% of lobsters have reached SOM) for the time period were 71.5-72.4 mm CL for Dingwall (LFA 27), 75.6-75.8 mm CL for False Bay (LFA 27) and 74.7-75.8 mm CL for Petit de Grat (LFA 29). The percent mature at the minimum legal size (MLS) based on logistic models ranged from 77-100%.

SOM estimates from a logistic model are not yet available but are being studied in LFAs 31 to 34. Results indicate an increasing SOM proceeding from the east to the west along the Atlantic coast of Nova Scotia. This is indicated by the higher proportion of sublegal lobsters that are mature in Canso (LFA 31a, 32-92% depending on sampling event) compared to Tangier (LFA 32, 6-22%) and Port Mouton (LFA 33, 0-5%).

Some questions were asked with respect to size selectivity of sampling. The objective was to sample 200 animals, but particular size classes were not targeted. The data should be examined for any size bias that is occurring because of this sampling regime.

It was noted that the spatial sampling did not sample the entire population. This effect should be evaluated for bias.

It was noted that size of maturity estimates vary annually and that more small lobsters were observed than expected. There was no interpretation possible at this time to explain this observation.

It was suggested to examine temperature data to determine if it could explain the annual variation in estimates of size of maturity.

EGG PRODUCTION INDICATORS

An index of egg production for LFA 31A is currently high. Size of maturity for all size classes with fecundity equations would be another method of obtaining an egg index.

FISHING PRESSURE

An index of exploitation rate (ER) was estimated using the Continuous Change in Ratio (CCIR) method, which utilizes the change over the course of the fishing season of the ratio between an unharvested size class (reference class) and a harvested size class in FSRs recruitment traps. The harvested size class was defined as MLS to 90 mm CL or 81 to 90 mm CL (LFA 27 only). Estimates were done for subunits and then weighted by landings to provide an index for the assessment unit as a whole. Weighting by landings was thought to be most appropriate for ER.

BYCATCH AND DISCARDS

The unintended capture of species that are not the target of a fishery is referred to as bycatch. Retained bycatch are either sold or used as bait, while discarded bycatch can be a source of mortality. Depending upon the LFA, fishermen can legally retain rock crab, Jonah crab, green crab and sculpins. In the lobster fishery, lobsters under the legal size, or those with eggs (berried) must be discarded. Depending upon the LFA, lobsters over a maximum size (LFA 30), in a window size (LFA 31a), or V-notched must also be discarded. While mortality amongst these discards is considered to be low, the amount of the discards has not been evaluated in the past.

Preliminary results from the 2009 to 2010 *Species at Risk Act (SARA)* bycatch study give the first systematic data on bycatch and discards in LFAs 27-34, giving an overview of the species caught, the estimated bycatch and discard rate (kg/ton lobster landed), and total in the fishery (kg).

The results obtained by the species at risk sampling project should be compared to the regular at sea sampling interpretation of bycatch and discards. The effect of trap-type on bycatch and discard composition should be evaluated. Determining the spatial distribution of bycatch and discards will be important for management. In this analysis, it is assumed there is no error in landings. This assumption should be added to the methods description. The percentage of the landings sampled should be explicitly stated to allow comparisons to the coverage in other fisheries. Ensuring consistency among observers will be important in future studies of this type. A method of evaluating the representativeness of the trips for sampling should be completed.

CONCLUSIONS

The conclusions of this meeting were captured in the associated Science Advisory Report (DFO 2011). Three DFO Science Research Documents are to be produced as a result of this meeting.

REFERENCES CITED

DFO, 2011. Assessment of Lobster off the Atlantic Coast of Nova Scotia (LFAs 27-33). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/064.

Reeves, A.R., J.S. Choi, and J. Tremblay. 2011. Lobster Size at Maturity Estimates in Eastern Cape Breton, Nova Scotia. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/079: vi + 18 p.

APPENDIX 1. Terms of Reference.**TERMS OF REFERENCE*****Assessment of the Status of LFA 27-33 Lobster Stocks***
Maritimes Regional Science Advisory Process**21-22 July 2011**
Dartmouth, NS

Chairperson: Ross Claytor

Context

The status of the lobster resources in Lobster Fishing Areas (LFAs) 27-33 was last assessed in 2004. Fisheries and Aquaculture management has requested updated information on the status of the LFA 27-33 lobster stocks. A framework meeting was held from February 1-3, 2011 to establish the scientific basis for the provision of management advice for these stocks (*insert reference to proceedings here*). This current assessment meeting will provide an update of the status of the LFA 27-33 lobster stocks following the new assessment framework.

Objectives

- Assess the stock status of the LFA 27-33 lobster stocks as of the end of the 2010 seasons.
- Estimate the relative exploitation rates over the last 10 years and evaluate the consequences of maintaining the current harvest levels.
- Estimate the level of discards (including lobster) and retention of non-lobster species in the LFA 27-33 lobster fisheries and report on what information is available on the survival of discarded species.
- Estimate the current values for female size at 50% maturity.

Expected PublicationsCSAS Science Advisory Report
CSAS Research Document(s)
CSAS Proceedings**Participation**DFO Science
DFO Fisheries Management
Provincial representatives
Industry, including Lobster Advisory Committee members and FSRS members
NGOs
First Nations

References Cited

DFO. 2011. Proceedings of the Maritimes Region Science Advisory Process to Review the Assessment Framework for Lobster Fishing Areas (LFA) 27-33 Lobster; February 1-3, 2011. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2011/021: iv + 28p.

APPENDIX 2. Agenda.

**Maritimes Science Advisory Process
Assessment of Lobster Stock Status in LFAs 27-33**

July 21-22, 2011

Chair: Ross Claytor
King Boardroom (Vulcan G-05)
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Thursday, July 21st

- 0900 Introduction and background
- 0915 Follow-up on points raised during framework
- 1000 Fishery Performance Indicators
- 1045 Break
- 1100 Abundance indicators from FSRS traps – pre-recruits and recruits
Temp corrected abundance for LFA 33
- 1215 Lunch
- 1315 Size at maturity
- 1400 Egg production indicators
- 1430 Fishing Pressure
- 1515 Break
- 1530 Bycatch and discards
- 1600 Conclusions
- 1700 End of Day 1

Friday, July 22nd

0900* – Review of Science Advisory Report

* meeting will adjourn when the review of the report is complete

APPENDIX 3. List of Participants.

Name	Affiliation
Armsworthy, Shelley	DFO Maritimes / PED
Baker Stevens, Nellie	Eastern Shore Fisherman's Protective Assn. (ESFPA)
Bennett, Lottie	DFO Maritimes / Science
Boucher, Gilbert	Richmond County Inshore Fisherman Ass. LFA 29
Boudreau, Ginny	Guysborough Co. Inshore Fishermen's Assn (GCIFA)
Boutilier, Randy	LFA 32
Brzeski, Veronika	Project manager for the LFA 27 management board
Cassista-Da Ros, Manon	DFO Maritimes / PED
Claytor, Ross	DFO Maritimes / PED
den Heyer, Nell	DFO Maritimes / Dalhousie University (Reviewer)
Denton, Cheryl	DFO Maritimes / PED
Gaudette, Julien	PES, Science Branch, SABA
Gray, Patrick	Halifax Commercial Fishermen's Assn.
Greening, Linde	NS Fisheries and Aquaculture
King, Patty	FSRS
MacDonald, Carl	DFO Maritimes / FAM
Martin, Tim	Native Council of NS (NCNS) Netukulimkewe'l Commission
Nowe, Gary	
O'Leary, Eugene	Guysborough Co. Inshore Fishermens Association (GCIFA)
Pearo, Tricia	Fishermen and Scientists Research Society (FSRS)
Peters, Gerard	DFO Maritimes / P&E
Pezzack, Doug	DFO Maritimes / PED
Silva, Angelica	DFO Maritimes / PED
Smith, Wilford	LFA 33
Spinney, Ashton	LFA 34 Mgmt. Board / Adv. Committee
Stanley, Ryan	University
Tremblay, John	DFO Maritimes / PED